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How Pemex plugged the interoperability gap

The 'digital oilfield' has been talked about for decades, been in practice for several years, but has not yet become a complete reality. Despite its early promise, one issue that has consistently impeded the digital oilfield is the management of massive amounts of data generated to assist the operator in making 'real-time' decisions. Here, **Javier Rodríguez Delfín** and **Rigoberto Saúl Villalobos Luna** of Pemex with Petrolink's **Adrehny Antonio León** and **Samuel Renee Pérez Bardasz** discuss the Mexican state operator's recent initiatives in this area.

One of the key barriers to effective real-time decision making is the lack of interoperability between vendor products. In any operator's real-time operating center, copious amounts of data are arriving from multiple vendor applications in different formats all at the same time to enable the operator's 'real-time' decision making.

Information technology professionals understand the importance of interoperability and know that the need to reformat data as it moves along the value chain or between stakeholders often is inefficient, error-prone and increases cost. Think about the problems that can arise from two people trying to communicate in two different languages. They can use a translator, but the process is slow, and if something small but vital gets lost in translation, it could mistakenly alter the context or desired outcome of the conversation.

Conversely, two people speaking the same language are operating with the same 'standard' and should have a much better chance of achieving successful communication.

An industry accepted standard for drilling data exchange exists for the digital oilfield and is used by many operators and service companies. WITSML is a global, industry-wide and vendor-neutral open data exchange standard to manage key information along the entire E&P value chain with the potential to solve data incompatibility problems, facilitate more efficient and seamless integration of this information, and improve implementation and operation of technology. This in turn enables E&P companies to improve economics and solve their business challenges as they relate to data.

Energistics, a not-for-profit organization, serves as the facilitator, custodian and advocate for the development and adoption of technical open data exchange standards such as the WITSML standard which is continually being enhanced with a common technical architecture for seamless data exchanges across the E&P life cycle.

A few years ago Mexican state operator Pemex was facing interoperability challenges so it decided to implement the WITSML standard to improve its drilling operations. At the time, Pemex was using about 10 different vendors for various activities from surface parameters to downhole tool parameters to LWD and this data from each vendor was being displayed on the same number of different screens, ultimately hindering quick and accurate decisions. Determining that it would use WITSML for all data exchange, Pemex was able to get all of this information down to three screens, but it determined that in order to make the best decisions for complex wells, it would eventually need the information to be delivered on one single viewer.

Due to the narrow operational

window given by the formation pressures and the fluid density in certain locations in Mexico, and in order to adhere to strict parameters, Petrolink has implemented real-time viewers fed by the Pemex WITSML 'store' powered by Petrolink, in which it is possible to combine various parameters from different companies responsible for data provision of downhole tools and surface parameters.

The primary challenge faced by Pemex concerning the drilling operation in some areas in the company's north region relates to monitoring the geomechanical model and the operational window – including pore pressure, fracture pressure, fluid density (for each different phase) and the equivalent circulating density (ECD) generated by the fluid and surface parameters.

The parameters monitored in real-time include:

1. Surface parameters: A mudlogging service company was responsible for providing surface parameters data: WOB, RPM, torque, pump pressure, strokes, ROP, volumes, gas, hook load, flow etc.

2. Downhole tool parameters: In order to keep track of the pressures generated in the borehole bottom, an Annular Pressure While Drilling (APWD) tool was used. This allowed the monitoring of the bottom pressure, temperature and equivalent circulating density.

3. Surface parameters while managed pressure drilling (MPD): This service was provided to take control of the equivalent circulating density by controlling the surface pressure with the use of adjustable and automated chokes, to neutralize the pressure effects in the formation and minimize the possibility of fluid flow from the reservoir to the borehole.

The combination of these three processes on a single viewer has been one of the most important factors in successful operations, providing the versatility as a tool for transmitting real-time data for decision making in a timely manner, when the reality contrasted with the preconceived geomechanical model.

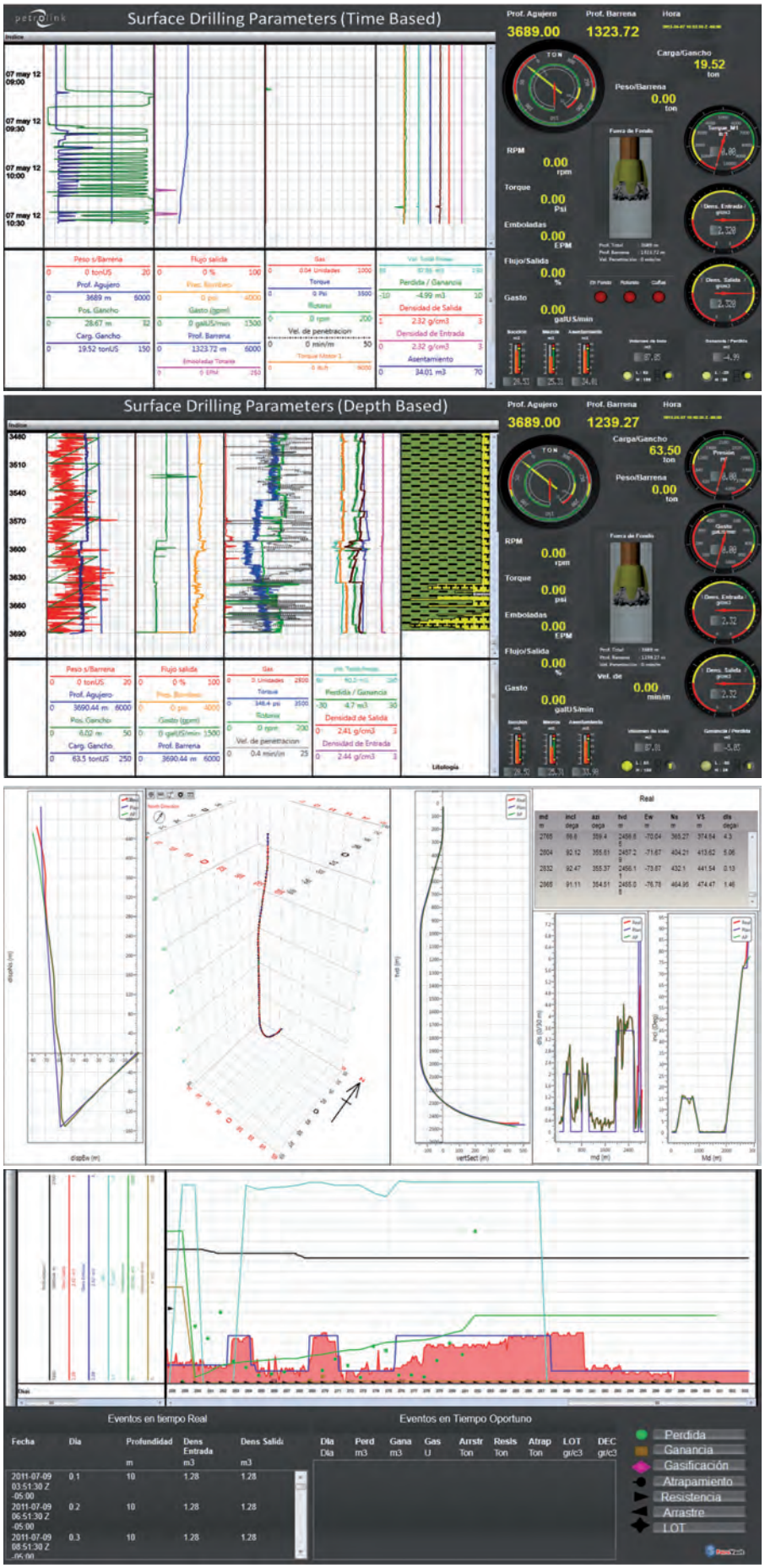
4. In addition, real-time logging-while-drilling data was collected and visualized for correlation with neighboring offset wells, to determine the formational tops to define the casing seat points, and to adjust the geomechanical model update in real-time. The logging-while-drilling data collected was: gamma ray, resistivity, conductivity, porosity, sonic etc.

5. Considering the imperative need to control and properly manage pressures, Pemex, through Petrolink technology, can now monitor pump operations with high pressure units (pump truck), cementing operations, formation integrity testing and leak off tests in real-time.

Petrolink's neutral and independent position allows that Pemex sees it as an ally in the collection and analysis of accurate data, with any missing or inefficient processes realized in real-time and adjusted accordingly. WITSML standards are now a contractual requirement of any vendor or service provider working with Pemex.

Although many might assume jobs would be lost because of reduction of screens being monitored, quite the opposite has occurred.

The introduction of these standards has created additional jobs; because there



*Surface parameters (*from top*): Surface parameter time based; Surface parameters depth based; Trajectory 2D/3D; Operational events.*

is more data to analyze, engineers are needed (drilling, geomechanics, geologists and IT) and the group has grown.

Challenges and solutions

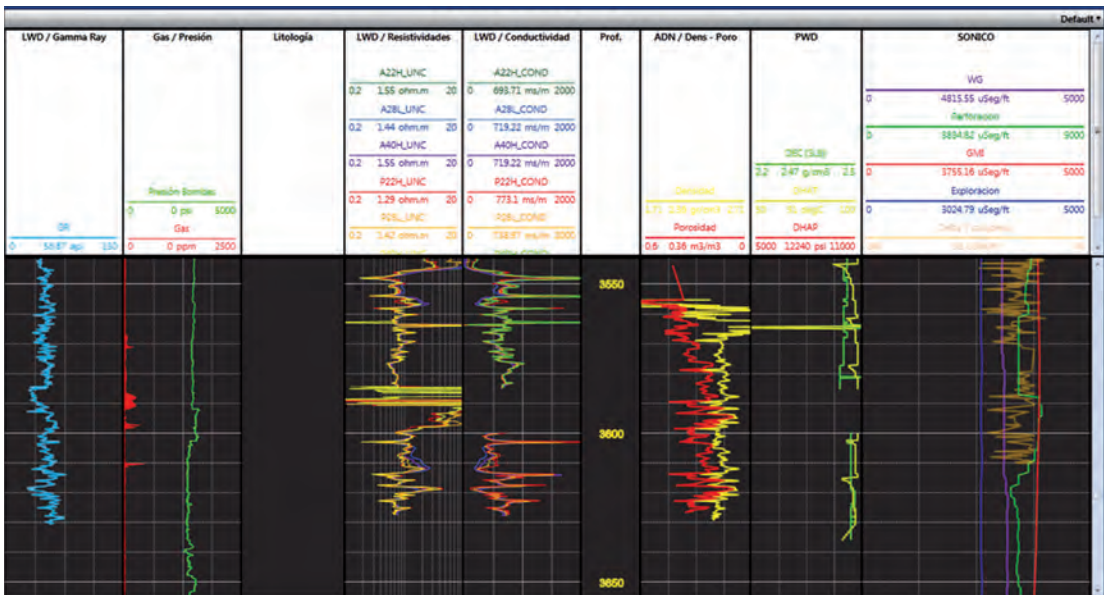
The concept of standards and collaboration is an easy sell; improving information flow is intuitive. Problems arise, however, when it comes to deploying standards. Many obstacles impede adoption:

- Most organizations are not starting from scratch; there is a lot of vested interest among vendors and many legacy solutions and entrenched internal practices.
- Everyone wants standards, but everyone wants their standards to be adopted.
- There is resistance to change: 'If a local system is working well, why adopt a global system?'
- There is platform lock-in; many vendors say their software can solve all of a users' problems, but there are hundreds of vendors offering good alternative solutions.
- Internal competition for resources within an oil company means deploying resources on standards directs those resources away from other valuable projects.
- Cross-discipline buy-in creates barriers. If a new standard affects the drilling department or the production engineering department or geosciences, those departments have to agree to apply it. Their take-up is the deciding factor.

Standards deliver value

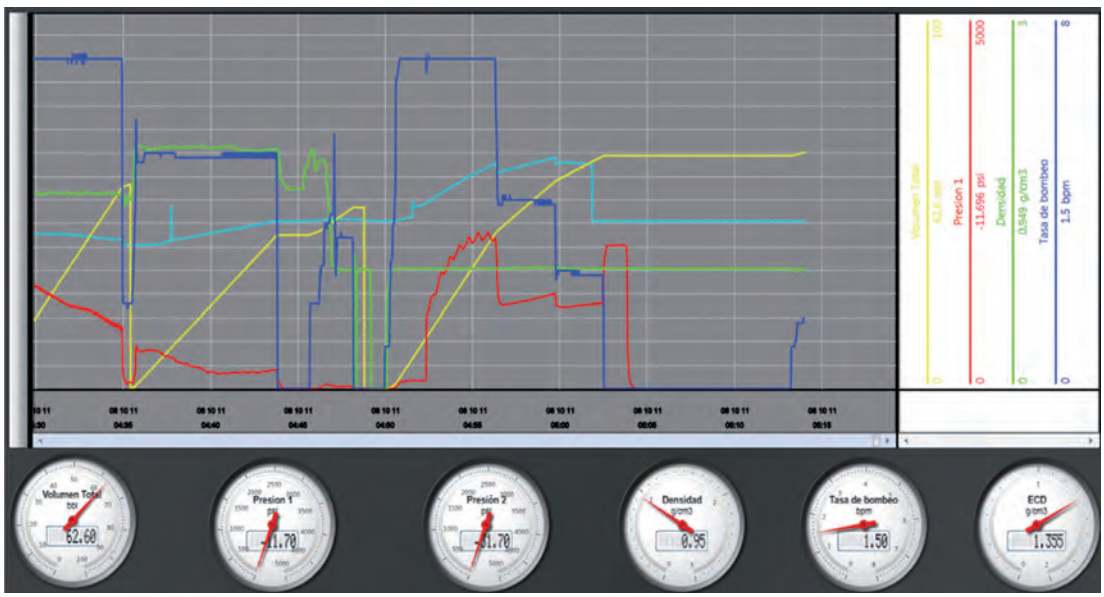
Standards promote many large-scale goals within the oil & gas sector. The industry, for instance, is striving for everyone to manage their information assets consistently, so they do not have to train people to do the same task in many different ways. The key is consistency in definition and in function, and that is the value of what the WITSML standard provides. Adopting and implementing standards means that the upstream sector can train employees, consultants and service providers with a common, core set of skills. It means that software tools can talk to each other without confusion, and participants can share information with others more readily.

Although many challenges remain, the oil & gas sector will benefit from a common shared language across the industry – the standard of best practices. This is vital in oil producing regions that are impacted by multiple operators in joint ventures engaging multiple vendors to deliver the real-time data. By improving the ability to encapsulate best practices through the effort of establishing standards, the industry



Two and four downhole tool correlation plot.

Surface parameters while managed pressure drilling (MPD) plot.



Cementing plot.

will be able to preserve much of the knowledge gained over the course of many years.

As with any new technology, benefits of standards-based technologies often are limited to the early adopters. Only when adoption and implementation become broad and deep do the benefits start to increase exponentially. When the upstream industry truly embraces and employs common standards-based technologies, the results will be revolutionary and the benefits transformational.

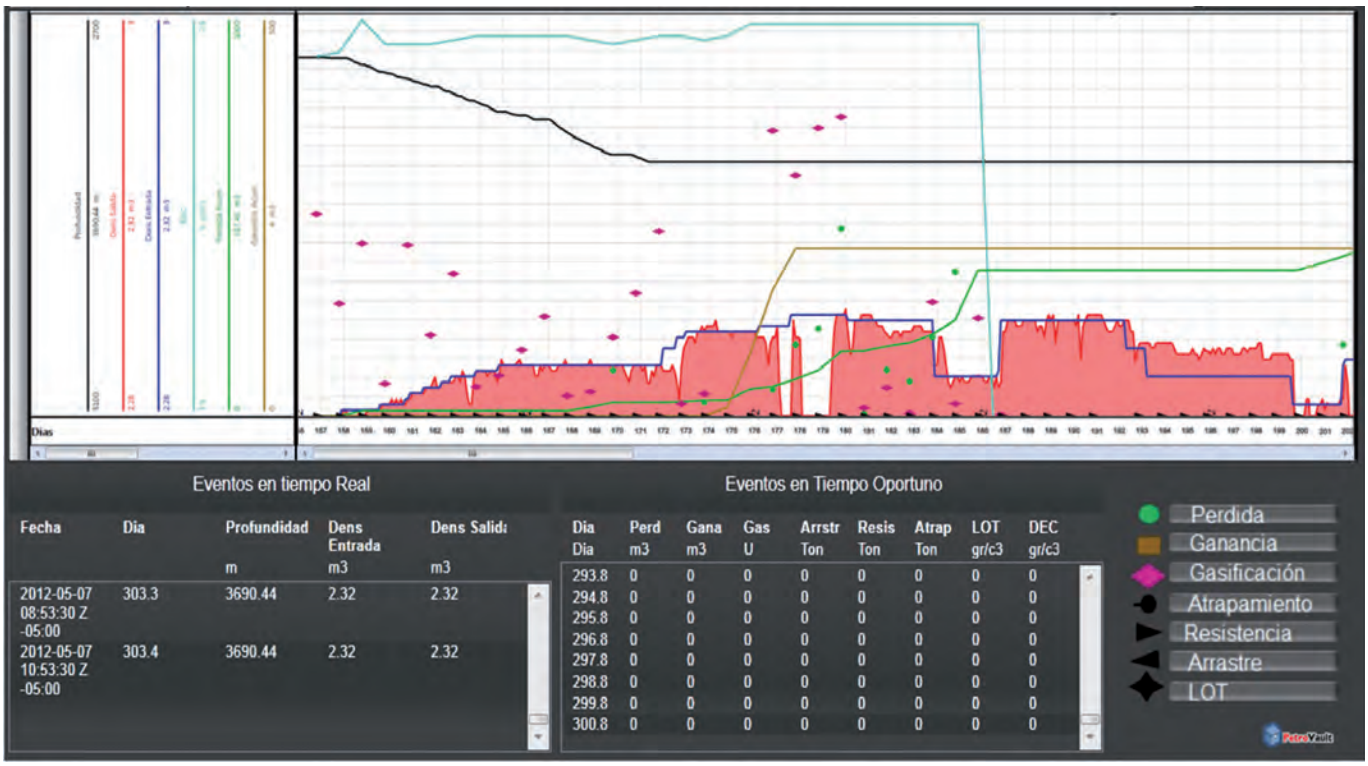
And ultimately the digital oilfield will become a reality. **OE**

Javier Rodríguez Delfín joined Pemex in 1991 and has been well-design and drilling engineering manager at the Veracruz drilling district unit for the last seven years. He has BSc in petroleum engineering and his team is responsible for all engineering and re-engineering.

Rigoberto Saúl Villalobos Luna joined the well-design and drilling engineering team in 2002, having previously worked at the Mexican Institute of Petroleum for six years. He earned a BSc in petroleum engineering from the Universidad Autónoma de México.

Adrehny Antonio León has been the Petrolink Real-time Service coordinator for the Mexico north region for the past two years. Prior to joining Petrolink, he held various drilling engineering positions with Venezualan state oil company PDVSA for 14 years. León earned his BSc in petroleum engineering from the Universidad del Zulia, Maracaibo.

Samuel Renee Pérez Bardasz joined Petrolink in 2007 and is currently Mexico operations manager. His team provides information management and real-time data solutions, drilling monitoring and re-engineering support to take decisions. He has a BSc in economics, and also earned an MSc in hydrocarbon enterprise from the University of Aberdeen.



Operational events plot.